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ABSTRACT

One of the most important tasks that teachers undertake is to teach concepts. Without a good understanding of concepts, students have difficulty even understanding the basics. Several approaches to teaching thinking have been analyzed and research concludes that it is more effective to teach thinking in the context of a subject rather than as a separate specially designed course. Three models that affect learning and teach students how to think in a subject are outlined. These models are the Concept Attainment, Inquiry Training, and the Advanced Organizer Models of Teaching. Sample lesson are given using the Concept Attainment and Inquiry Training models to help readers understand how models can be employed in the visual arts. Concept maps have been shown to be highly effective teaching tools, therefore, this technique is emphasized in the discussion of the Advanced Organizer model. Two examples of concept maps involving two different topics in the visual arts also are presented. (KM)

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Teaching Concepts and Skills of Thinking Simultaneously

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presented at the
National Art Education Association
Conference

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The Significance of Concepts

The teaching of concepts is probably the most significant task that teachers undertake. Without a good grasp of concepts the individual has much difficulty in understanding even the basics much less performing tasks successfully in a given subject. Not knowing the concept of prime number severely limits a student in math when he/she attempts to reduce fractions to lowest terms. Inability to distinguish the concept of positive space from negative space affects the student's effort to make an effective visual statement in art. How we teach these concepts may well be part of the problem.

The teaching of concepts to students more often than not goes something like this: Teachers give students a definition of the concept orally and/or by writing it on a chalk board or including it on a handout. Students are then asked to transfer this new knowledge to a task of some kind. In many instances they are tested in some way to determine how well they have comprehended the concept. Little or no real thinking is required of the student beyond simply being able to identify a definition or being able to reproduce it in written form. The more fortunate students are given examples of the concepts early on to enable them to distinguish them from non-examples. However, even here, the students are merely required to identify the examples based on the definition. And many times they are not able to identify the correct examples even after several reteaching episodes. When students are asked to apply the concepts in some way it soon becomes apparent that they have, at best, a superficial understanding of the concept. They may be able to recognize the name of the concept but not the concept itself. Failure to distinguish between these two elements has led to confusion and to muddled thinking. "Nonobjective art" is a concept name. The concept itself, however, encompasses a multitude of characteristics and qualities, (we will call attributes) that is perceived to be the concept itself. Moreover, being able to think about these attributes in such a way that those that are deemed essential are categorized and differentiated from these that are not essential constitutes a fundamental thinking process that should be nurtured if teachers desire to have students learn some crucial skills of thinking.

Teaching Concepts and Skills Simultaneously

A variety of approaches to the teaching of thinking has been analyzed by such investigators as Carl Bereiter. He has classified these approaches into three categories. Only one of these, he has found, has any real promise. This, he labels the "pervasive" approach (Bereiter, 1984, pp. 75-77). The basic idea is that it is more effective to teach thinking in the context of a subject rather than as a separate subject in a course on "how to think" or in "enrichment" type courses. Thus, the teaching of thinking "pervades" the subject matter in such a way that students learn how to think in relation to the subject they are studying. The thinking skills they learn in turn, can enable them to "learn how to learn" a variety of concepts and generalizations.

The Models Approach

A model of teaching is like a "blueprint" from which teaching strategies are developed that not only effect learning in a given subject but also teaches students how to think in that subject. They, in effect, learn how to learn. In their book entitled Models of Teaching, Bruce Joyce and Marsha Weil (1986) have compiled a number of models that can be effectively employed in this manner in any subject. They state: *"We have a substantial storehouse of models of teaching that directly teach both content and intellectual process. Although we always need to invent more, the existing storehouse is more than adequate to create programs that will develop many of the most powerful ways of thinking that have been discovered".* (Joyce & Weil, 1986, pp. 423.)

To fully describe this "adequate storehouse of models" is beyond the scope of this paper. However, three such models will be addressed. These are the Concept Attainment, Inquiry Training and the Advance Organizer Models of Teaching. The "syntax" or sequence of the activities of each model (called phases) will be given. To enable the reader to grasp how models can be employed in visual art, lesson examples will be given using the Concept Attainment and Inquiry Training Models. Inasmuch as the use of Concept Maps have been shown to be highly effective teaching tools, this technique will be emphasized in the discussion of the Advance Organizer Model.

The Concept Attainment Model

This model is designed to teach students how to learn concepts by determining the essential differences between examples and non-examples of a concept through an inductive thinking process. This model contains three phases. The following scenario is given to provide the reader with an example of how the model could be used teaching a topic in a unit as "styles of art."

Phase One: Presentation of exemplars of the concept

The teacher first tells the students that they are going to learn a concept. Next, they can be told that they will see both, positive and negative examples of the concept. (These are collectively called "exemplars".) He/she then presents several exemplars telling the students whether they are positive ("yes") or negative ("no"). They are asked to look for the characteristics of the "yes" examples that are not found in the "no" examples.

For example, if the concept is "nonobjective art" the teacher may present a reproduction of one of Mondrian's later works such as Composition with Blue Plane, 1921 as the first "yes" example. In contrast, the teacher may then present a negative example such as Madonna and Child by Marco Basaiti. Next, the teacher may show a reproduction of Franz Kline's Marc C. Several additional positive and negative examples could then be presented. The students are asked to list those characteristics that the positive examples have in common. They should discover that the "yes" examples contain no objects that can be named, i.e. tree, house, face, etc., while the "no" examples contain such identifiable objects.

Phase Two: Testing Attainment of the Concept

The teacher then presents examples that are not identified as "yes" or "no." The students then are to determine the class to which they belong based on their lists of what they believe to be the essential characteristics or what Bruner calls "essential attributes" (Bruner 1956) of the "yes" examples.

When all or most all of the exemplars are correctly identified, he/she asks students to develop a statement that defines the concepts. This, the students are told, is what is called a hypothesis. Their hypothesis should contain what students believe to be the essential attributes of the concept. The teacher then asks the students to "test" the hypothesis against the data they have so far collected. To test the hypothesis the teacher has the students point out where their hypothesis is satisfied in the "yes" examples and not in the "no" examples. If their hypothesis is confirmed, the teacher names the concept: "nonobjective art", followed by a definition of the concept, which Bruner calls the "concept rule" (Bruner, 1956). The concept rule contains three elements. The concept name is stated first. Second, the general class to which it belongs. Third are the essential attributes of the concept. The teacher could thus say: "Nonobjective art is a style of art which employs color, line, texture, and unrecognizable shapes and forms. These works contain no apparent reference to reality" (Mittler, 1986, p. 340).

If a student's hypothesis is not confirmed, the teacher may then present additional exemplars and ask the student to think about the patterns he/she sees in the "yes" examples. Thus, the student finds that he/she will have to modify the hypothesis in terms of the positive examples. The student may have to explore a number of alternate hypotheses until one has the correct "fit." The teacher can now be reasonably sure that the students have attained the concept. But to further test concept attainment, he/she could have each student differentiate nonobjective art examples from non-examples of the concept.

Phase Three: Analysis of thinking strategies

After it is apparent that the students have attained the concept, the teacher asks the students to describe their thoughts as they participated in the concept attainment. He/she could ask such questions as: "What steps did you take in your mind as you observed the exemplars and discovered what you believed to be the essential attributes of the concept?" "What hypothesis did you originally have that later had to be altered?" What exemplars (both "yes" and "no") prompted you to change your mind?" "Why?", etc. At this point, certain "non-essential attributes" could be discussed. Non-essential attributes are those characteristics of exemplars (both "yes" and "no") that really do not make a difference. For example, it really does not make a difference what the size of the paintings or sculptures are, or the elements and principles the artist employs, or for that matter, even the media used. A discussion can be held about how non-essential attributes could be mistaken for those that are essential to the concept. For example, a student may hold fast to the notion that those works that contain only straight lines (such as in the Mondrian examples) are essential attributes. Therefore, when shown a reproduction of Vasily Handisky's Improvisation 28 (Second Version) 1912, a painting having a variety of curved and straight lines, he/she may declare that this is a "no" example of the concept. Discussion may also center around the subtle differences between "abstract", abstract expressionist" and "nonobjective art." Thus, the students could discover that nonobjective art is, in reality,

a subclass of "abstract art." A concept map could be drawn indicating the relationships among these concepts (see the Advance Organizer Model).

Finally, the teacher could apply the process students have learned to aspects of life itself. For example, we should not be too quick to judge an object, an event, or a person using evidence which is based on a small number of examples. Generalizing on limited samples is all too prevalent in our society as it is. Also, the non-essential attributes of the concept of "human beings" can be discussed. For example, it doesn't make any difference whether we are short, tall, fat, skinny, or what color skin we have. We are all classified as true human beings that have all of the essential attributes of "humans" no matter what our ethnic origins may be.

We have found this model as well as other models of teaching to be especially powerful in terms of long term memory. Students learn that they "own" the concepts. They are theirs rather than the teacher's because they played a significant role in attaining the concept.

THE INQUIRY TRAINING MODEL

This model is designed to teach students how to learn an inquiry process by asking questions and developing hypotheses concerning a puzzling problem called a "discrepant event." This problem must be mysterious to the students, one that defies logic. In preparing to use this model the teacher must make sure that the puzzling problem is indeed discrepant to the students. Otherwise there will be little or no true inquiry. Also the teacher must teach students how to ask questions concerning the discrepant event. The following list can be used to assist the teacher in training the student to ask valid and effective questions.

1. Insure that questions are phrased so they can be answered with a yes or a no, and that their substance doesn't require the teacher to do the inquiry.
2. Ask student to rephrase invalid questions.
3. Point out unvalidated points--for example. "We have not established that this is liquid."
4. Use the language of the inquiry process--for instance, identify student questions as theories and invite testing (experimenting).
5. Try to provide a free intellectual environment by not evaluating student theories.
6. Press students to make clearer statements of theories and provide support for their generalization.
7. Encourage interaction among students. Joyce & Weil (1986) p. 69.

The following is an example of an inquiry training lesson using simultaneous contrast as a discrepant event.

Phase One: Confrontation With The Problem

A. Explain Inquiry Procedures.

The teacher could say something like:

1. "I am about to show you something that may be puzzling to you and requires an explanation of some kind."

2. "In seeking this explanation remember you are to ask questions in such a way that they can be answered with 'yes' or 'no' only."
3. "After we have found out more about this problem you could make 'educated guesses' or hypotheses that could explain this problem--but first we must collect the data."

B. Present the Discrepant Event

1. The discrepant event "Simultaneous Contrast" is presented.

   Two orange rectangles are seen, one on a field of red, the other on a field of blue. The orange rectangle on the field of blue appears to be brighter (or to some, larger) than the orange rectangle on a field of red, yet the two orange rectangles are of exactly the same value and intensity and are the same size.

2. The teacher makes sure all students can see this problem and there is sufficient light and now tells the students to ask questions to find out more about what they are seeing.

Phase Two: Data Gathering and Verification

A. Verify the Nature of Objects and Conditions

Possible questions students may ask.

- Q1 "Are the two orange rectangles the same size?" (Yes)
- Q2 "Is one orange rectangle darker than the other one?" (No)
- Q3 "Are the two orange rectangles the same intensity?" (Yes)
- Q4 "Are they the same value?" (Yes)

B. Verify the Occurrence of the Problem Situation

Possible questions students may ask.

- Q1 "Does the orange rectangle on the field of blue appear to be brighter because orange is quite a bit different from blue?" (Yes)
- Q2 "Does the orange rectangle in the field of red appear to be duller because red is quite similar to orange?" (Yes)
- Q3 "Are the colors (hues) red and orange of less contrast than the orange and blue?" (Yes)
- Q4 "Would there be a similar effect if you showed different contrasting hues?" (Yes) - (This could be verified by showing two red rectangles, one on a field of green and the other on a field of orange).
- Q5 "Does it make any difference if the red and blue fields are covered?" (yes) (This could be verified by covering the blue field).

Phase Three: Data Gathering, Experimentation

A. Isolate relevant variables

Possible questions students may ask.

- Q1 "Does this contrast have anything to do with the properties of light?" (Yes)

Q2 "Does it make any difference if there were less light?" (Yes)
Q3 "Does it have anything to do with wave lengths of hue?" (Yes)
Q4 "Are the wave lengths of reds and oranges longer than those of blues and greens?" (Yes)
Q5 "Can the apparent brightness of the orange rectangle in the blue field be attributed to a contrast in the wave lengths of the orange and blue hues?"

B. Hypothesize (and test) causal relationships

As with all questions that could be restated as a hypothesis, the teacher could ask the student.."Would you restate this question in the form of an hypothesis that could explain this discrepant event?"

After an hypothesis is stated it is important, for the sake of inquiry, for the teacher to say something like: "OK, let's test this hypothesis to see if it does indeed explain why one orange rectangle appears to be brighter than the other," rather than to flatly state: "That's right!" Inquiry would cease at this point.

Phase Four: Organizing, Formulation, and Explaining

A. Formulate Rules or Explanations

The following information from a "fact sheet" can be used to help the students understand the explanation for the discrepant event:

1. No object contains color "with-in" itself.
2. Color is perceived by the eye as reflected wave lengths of white light.
3. The so called warm hues - yellow, red, orange have longer wave lengths than do the cool hues - greens & blues
4. The rods and cones of our eyes "see" the different wave lengths simultaneously.
5. The reds and oranges having the longer wave lengths are perceived by the eye as advancing hues, while greens and blues are seen as receding hues.
6. Adjacent hues having these advancing and receding effects create a contrast that makes the reds and oranges appear to be brighter than those that are not adjacent to blues and greens.
7. This is especially apparent when two highly contrasting hues such as orange and blue are seen simultaneously.

Phase Five: Analysis of the Inquiry Process

A. Analyze the inquiry strategy and develop more effective ones. This is a crucial phase of the model because the purpose of this model is to teach the process of inquiry. It is important, then, to devote sufficient time and effort to this phase. The teacher could ask questions such as:

1. "What questions were most effective in leading you to a hypothesis?
2. "What questions were not so effective?"
3. "What were your thoughts when you developed an hypothesis that was later shown to be invalid or had to be revised?"

4. "What questions were most effective in leading to the valid hypothesis?"
5. "What have learned about this process?"
6. "What suggestions do you have that would make this inquiry more effective?"

Finally, the teacher could discuss where the process could be used in addressing other problems. For example, why are Vincent VanGogh's paintings currently selling for millions of dollars yet only one of his paintings was sold during his life time? Or, the process could be applied to solving everyday problems. For example, why does it seem to take longer to do something one does not enjoy doing than it does for something that is highly enjoyable? (like art!) We may discover that we could interrelate many different subject areas. For example, could Einstein's theory of relativity have anything to do with the last problem? The point here is that we are continually inquiring about our world because much knowledge about this world is not only unknown but it is also rapidly changing. Thus we (both teachers and students) are engaged in a never ending quest for knowledge. The Inquiry Training Model is one tool we can use to become actually engaged in this quest.

The Advance Organizer Model

Although most, if not all, of the models have usefulness in the teaching of science, one model especially has most utility since it is the most flexible as well as the most often employed model in public schools. This is the Advance Organizer Model.

The Advance Organizer Model (Ausubel, 1960) is a deductive information processing model designed to teach interrelated bodies of content. This is in contrast to inductive approaches that lead students to discover concepts. The Advance Organizer Model, instead, provides concepts and principles to the students directly.

There are three "phases" to the model. The advance organizer itself is the first phase. It organizes in advance the learning of content that is of a more specific nature later in the second phase of the model. The third phase is designed to interrelate the new concepts and to relate phase two learnings with the organizer. The organizer acts as a connection between the content to be learned and the learner's cognitive structure. In other words, the organizer relates and reconciles what students already know with what they will be learning. The more the organizer is linked to what students already know, the more they are apt to learn the material that follows.

A critical feature of the organizer is that it is built around the major concepts and prepositions of a discipline. In other words, it acts as a "cognitive roadmap" that guides the students over new content. Another way to look at this is that the organizer provides students with "intellectual scaffolding" on which the new content can be logically placed.

The direct effects on students of the Advance Organizer Model, according to Joyce and Weil (1986), are that students learn the conceptual structures of a discipline as well as a meaningful assimilation of bodies of information and ideas. Interest in inquiry and habits of precise thinking are effects that have a more indirect affect on students.

The use of advance organizers by teachers is an attempt to link prior learning to new material, and to provide content structure for this new material has been the subject of much research interest (Barnes & Clawson, 1975). When used in

appropriate situations, advance organizers appear to influence the outcome of learning (Mayer, 1979).

The Graphic Advance Organizer

More recently, researchers have turned their attention to an "off-shoot" of the advance organizer: the graphic advance organizer, or more simply, the graphic organizer. Graphic organizers (sometimes referred to as "structured overviews") use diagrams, hierarchies, charts and drawings to indicate relationships between concepts. This method for graphically showing the organization of significant concepts to be learned has been widely recommended as an aid for comprehension (Hawk & McLeod, 1985). Research findings indicate that when graphic elements are introduced into advance organizers, learners recall more information (Schwartz and Kulhavy, 1982). Research that studied the effects of graphic organizers on secondary students found significant increases in student achievement (Hawk, et al., 1981, Hawk, 1986). Hawk (1986) indicates that there are a number of reasons why graphic organizers enhance learning. Graphic organizers:

1. provide an overview of the material to be learned;
2. provide a framework that provides reference points for organizing the main concepts into a logical pattern;
3. cue students as to what to look for as they read their written materials;
4. give stability to the new information thus strengthening the learner's retention.
5. Finally, the graphic aspect of the organizers help to construct a framework of vocabulary and concepts that can be effectively used to
    a. introduce new content
    b. help students in the learning task and
    c. serve as an effective review of content.

Types of Graphic Organizers

I have found that three basic types of organizers are very effective in helping students to see the structure of content no matter what this content may be. (See figure 1.) The first and probably the most familiar type is "Hierarchy Structures". The most general concepts are placed at the top. These concepts are the most inclusive of all the concepts in the organizer and are many times referred to as "superordinate concepts." The more specific concepts are those placed under the above concepts and found with connecting lines. The second type of graphic organizer is the "concept map" which is similar to the Hierarchy Structure in that it takes on the hierarchial form but also has propositional statements that tell how concepts are linked as well as "cross-linked" to connect concepts horizontally as well as vertically. The third type of graphic organizer is really a combination of the two kinds: diagrams and pictures. This type of organizer is by its very nature the most creative in that new and original modes of connections, changes and diagrams can be employed.

Although all three types of graphic organizers have been employed by teachers, concept maps will receive the most attention in this paper because this type can be more directly and quickly created by teachers as they graphically structure content to

first further their own understanding of the interrelationship of the concepts to be taught. Teachers have found them to be an important first step in order to make effective graphic organizers for classroom use.

Concept Mapping

(The following information has been taken in part from Strategies for Teaching Earth Science, Facilitators Manual, College of Education, Texas Tech University.)

Concept mapping (known to some educators as "mind mapping") is a visual representation of cognitive structure. It has four major components: concepts, relationships (propositional linkages), hierarchy, and cross-links. First, concepts are what we think with. Second, concepts are related to each other by linking words. Two concepts with a labelled relationship form a "proposition". Third, the concepts are linked together into a hierarchy from the most general concept at the top of the map to progressively more specialized concepts at the bottom of the map. Finally, cross-links are relationships that are made between concepts in two different domains on the map. These connections are significant because they point out interrelationships.

A "good" concept map has many concepts, levels of hierarchy and cross-links. No two concept maps are identical. Each student's map represents a personalized view of a given area of knowledge. A completed concept map represents an understanding of the relationships entailed by an important set of concepts and effectively communicates this understanding to others.

Concept maps teach students how to learn effectively. Too often students memorize facts which are forgotten within a few weeks. In contrast, concept maps help students link new information with existing relevant concepts which then undergo further development or differentiation.

There are six steps to concept map making:

Step 1: **Select** an item for mapping. This may be a short section of a textbook, lecture notes, laboratory or studio activity, etc.

Step 2: **Identify** the major concepts (object, events) by listing or underlining. (Each of the concepts can be copied onto a separate small card for easy rearrangement).

Step 3: List or **rank** the concepts from the most inclusive (most general) to least inclusive (most specific). For example: "art" (most general) then "painting" (more specific), and finally "water color" (most specific).

Step 4: **Arrange** the most general concept at the top of the map. Link it to less inclusive concepts. Label all lines with linking words that explain how each pair of concepts is related. The map should read top to bottom.

Step 5: Try to **branch out**. Add two or more concepts to each concept already on the map.

Step 6: Make **cross-links** between two concept that are already on the map. Label all cross-links with words that explain how the concepts are related. Draw these links with an arrow so the reader will read in the intended direction.

Because of the flexibility of concept maps, they can be used for several different purposes. These uses are (1) as curricular tools; (2) as instructional tools; and (3) as a means of evaluation. As curricular tools, concept maps can be an important tool to

focus the attention on the teaching of concepts and on the distinction between curricular content that is to be learned and instructional content which is to serve as a vehicle for learning. A completed concept map is the cognitive component of the curriculum and portrays the structure in a discipline.

The concept map as an instructional tool can be used to plan a lesson, integrate a series of lessons, and supplement lectures, laboratories, art studies, and readings, and the text. They can insure that organization exists. It is important to have students construct concept maps. Concept maps can be useful in evaluating student knowledge. Essay questions can be replaced by a mapping exercise where the students are given concepts and must construct a map.

Two examples of concept maps are given in figures 2 and 3, and represent the structure of content involving two different topics in art. The concept map in figure 2 is an effort to graphically portray the concepts involved in Twentieth Century art as given in Gene Mittler's (1986) book Art in Focus. Figure 3 portrays a concept map of four elements I have used with students.

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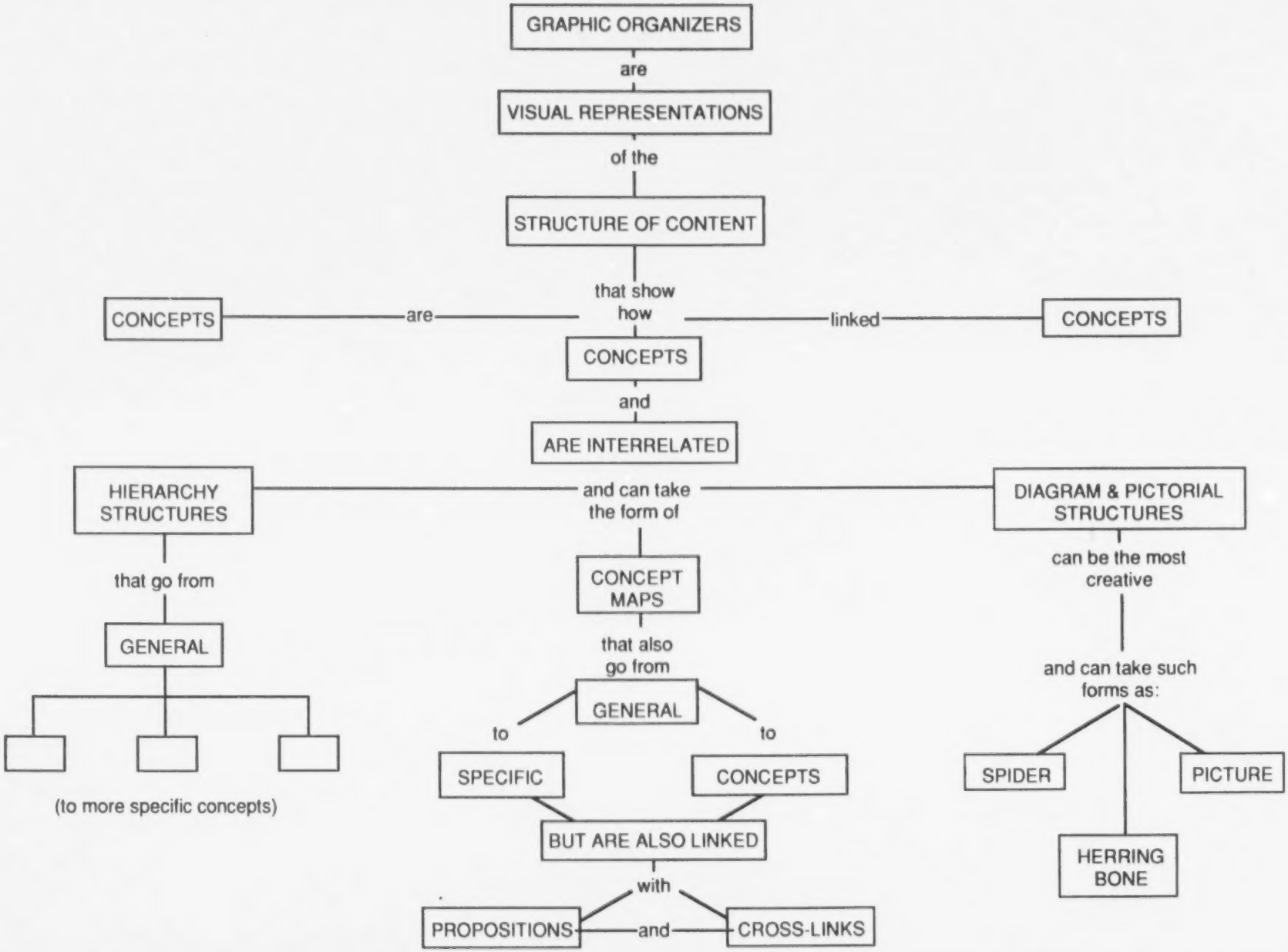
GRAPHIC ORGANIZERS
are
VISUAL REPRESENTATIONS
of the
STRUCTURE OF CONTENT
that show how
CONCEPTS
are
linked
CONCEPTS
CONCEPTS
and
ARE INTERRELATED
HIERARCHY STRUCTURES
and can take the form of
DIAGRAM & PICTORIAL STRUCTURES
that go from
GENERAL
(to more specific concepts)
CONCEPT MAPS
that also go from
GENERAL
to
to
SPECIFIC
CONCEPTS
BUT ARE ALSO LINKED
with
PROPOSITIONS
and
CROSS-LINKS
can be the most creative
and can take such forms as:
SPIDER
PICTURE
HERRING BONE

Figure 1

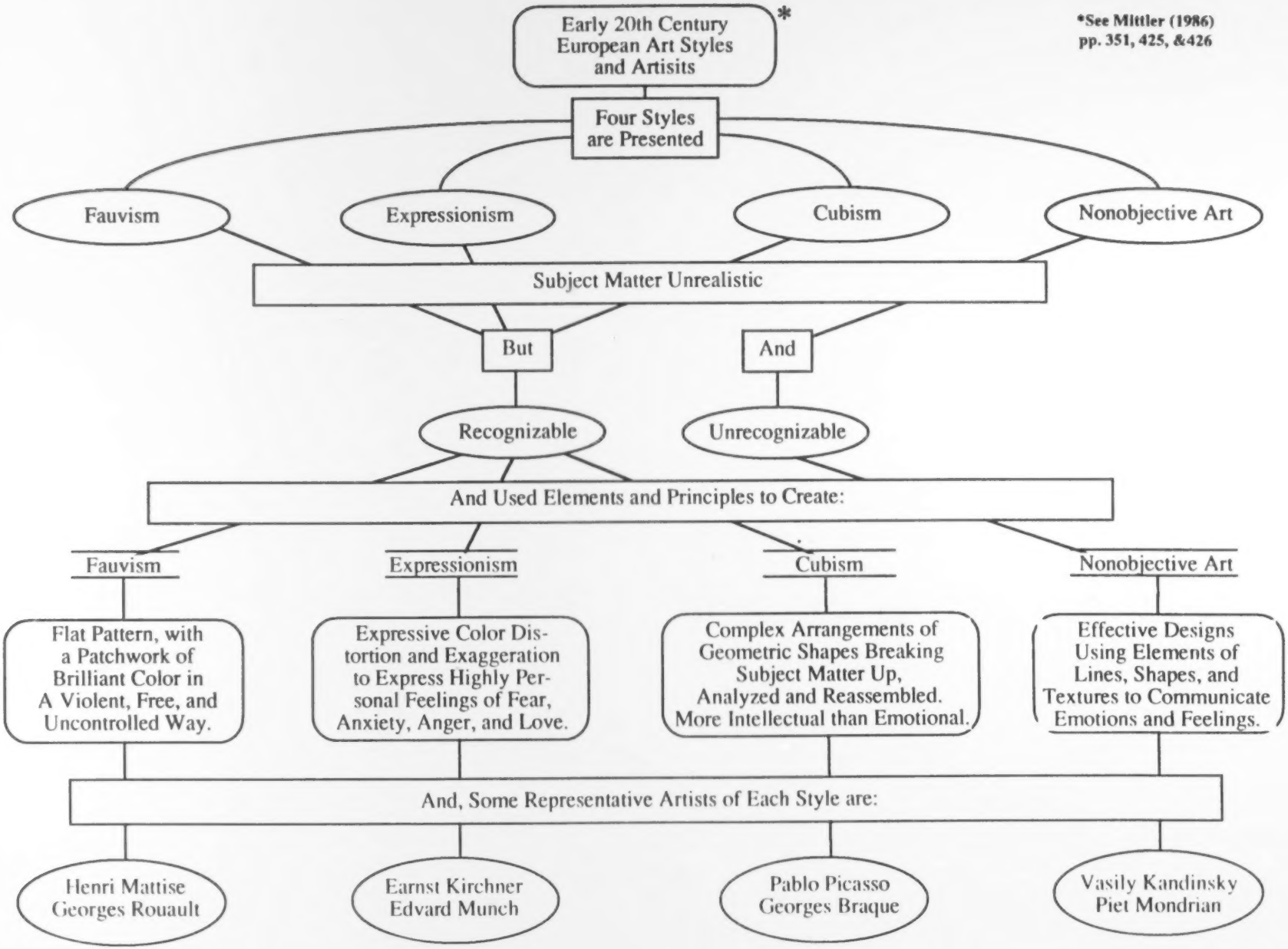
Early 20th Century European Art Styles and Artisits
*
*See Mittler (1986) pp. 351, 425, &426
Four Styles are Presented
Fauvism
Expressionism
Cubism
Nonobjective Art
Subject Matter Unrealistic
But
And
Recognizable
Unrecognizable
And Used Elements and Principles to Create:
Fauvism
Expressionism
Cubism
Nonobjective Art
Flat Pattern, with a Patchwork of Brilliant Color in A Violent, Free, and Uncontrolled Way.
Expressive Color Distortion and Exaggeration to Express Highly Personal Feelings of Fear, Anxiety, Anger, and Love.
Complex Arrangements of Geometric Shapes Breaking Subject Matter Up, Analyzed and Reassembled. More Intellectual than Emotional.
Effective Designs Using Elements of Lines, Shapes, and Textures to Communicate Emotions and Feelings.
And, Some Representative Artists of Each Style are:
Henri Mattise
Georges Rouault
Earnst Kirchner
Edvard Munch
Pablo Picasso
Georges Braque
Vasily Kandinsky
Piet Mondrian

Figure 2

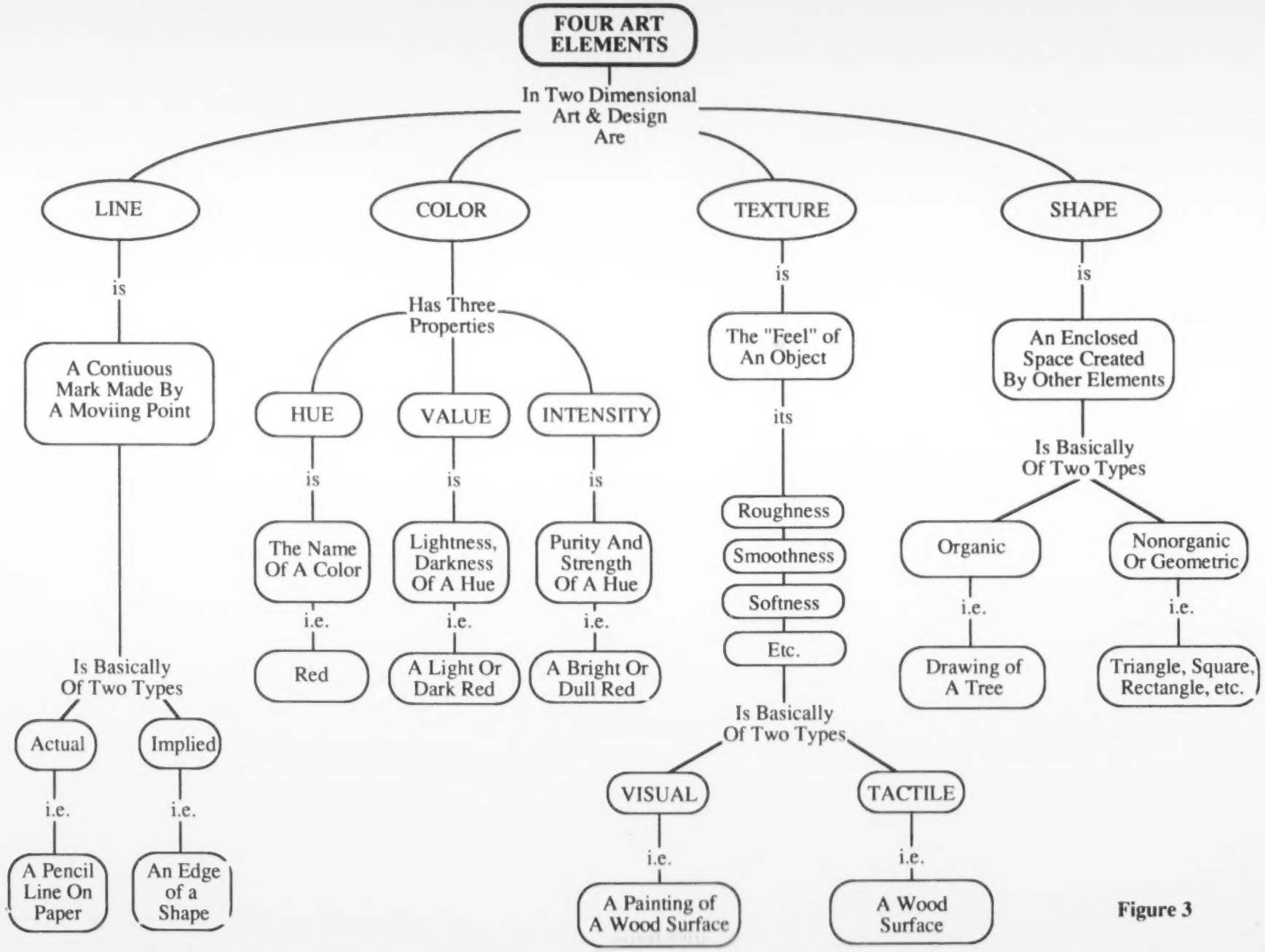
FOUR ART ELEMENTS
In Two Dimensional Art & Design Are
LINE
is
A Contiuous Mark Made By A Moviing Point
Is Basically Of Two Types
Actual
i.e.
A Pencil Line On Paper
Implied
i.e.
An Edge of a Shape
COLOR
Has Three Properties
HUE
is
The Name Of A Color
i.e.
Red
VALUE
is
Lightness, Darkness Of A Hue
i.e.
A Light Or Dark Red
INTENSITY
is
Purity And Strength Of A Hue
i.e.
A Bright Or Dull Red
TEXTURE
is
The "Feel" of An Object
its
Roughness
Smoothness
Softness
Etc.
Is Basically Of Two Types
VISUAL
i.e.
A Painting of A Wood Surface
TACTILE
i.e.
A Wood Surface
SHAPE
is
An Enclosed Space Created By Other Elements
Is Basically Of Two Types
Organic
i.e.
Drawing of A Tree
Nonorganic Or Geometric
i.e.
Triangle, Square, Rectangle, etc.

Figure 3